turing to hint that they would soon pass them. Now, however, as usual with all changes in England, the progress there has taken a great step forward, and even the lines south of London, or more properly speaking, of the Thames Valley, are waking up, and the French also have ventured to reduce the time of the Calais and Paris express some fifteen minutes.

The fastest train between London and Edinburgh has hitherto been the Great Northern, from King's Cross, and it has performed the journey of 396 miles in nine hours. This same train now performs the distance in eight hours and a half, and of this time there are twenty minutes taken up for lunch at York, so that the run is seen to be very excellent indeed. On the other hand, the Northwestern, which has hitherto done the 401 miles between London and Glasgow in ten hours, has knocked off a whole hour, and runs the distance in nine hours, at a speed of forty-four and a half miles per hour, including stoppages, which consume forty-five minutes. Hence, while running, the speed is over forty-eight and a half miles per hour. Of the distance of 401 miles, 190 are over the hills of the Lake district and the Scottish Lowlands, but are covered at the same speed, about forty-seven miles per hour. The Northwestern line has to climb to an elevation of 870 feet over Shap Fell, and the Caledonian sixteen hundred feet at Beattock, with long grades of seventy and seventy-five feet to the mile in both cases. The Midland, again, which attains an elevation of fifteen hundred feet near the head of the Eden Valley, and has a large number of severe curves and gradients, runs 423 miles between London and Glasgow in nine hours and twenty minutes. This is really a better performance than that of the Northwestern, for one of its trains runs twenty-two miles further in only twenty minutes more time. Of the sixty minutes reduction in time by the Northwestern train from Euston station, it is remarkable that the whole of it is taken out of the running time, for the stops are as frequent and as long as before.

The 250 miles between Manchester and Glasgow are completed in five hours and fifty minutes, with six stoppages.

Between Manchester and London there are run daily no fewer than forty-two trains, which maintain a speed, including stoppages, of over forty miles per hour, and as many as twenty-seven similar trains between London and Liverpool. From London to Manchester is 203½ miles, and the shortest time is four and a quarter hours, by the Great Northern, with a climb of a thousand feet, in Longdendale near Penistone. This run includes a stop of five minutes at Grantham and of four minutes at Sheffield. The time of this train is three hours and twelve minutes to Sheffield, which is 162¼ miles from London. The speed is thus close upon fifty-one miles to Sheffield, or, deducting a stop of five minutes at Grantham, over fifty-two miles per hour, and this allows nothing for the slacking off at stops and the time lost in attaining full speed, this loss being always considerable with the large-wheeled engines used in England.

These fast English expresses are by no means light trains: the Scotch expresses especially are long, fully loaded trains, and the speeds attained with regularity and punctuality as well as economically as regards fuel, ought to receive attention on this side of the Atlantic, where it is the fashion to believe or pretend to believe that English locomotives are inferior machines, and universally provided with rigid wheel base, and unprovided with either bogies or other means of axle radiation.

The incorrectness of this assumption is shown by the following facts. The three routes to Scotland are worked by the somewhat different types of locomotives owned by four English and three Scotch railways. One company, the London and Northwestern, employ a single pair of wheels in radial guides under the front end of the engine. Another, the Great Northern, use a four-wheel truck with cylindrical centre pin and no lateral motion, and the five others employ the Adams four-wheel bogie, which has practically universal motion, the centre pin being a portion of a sphere, and the lateral motion being regulated by adjustable springs instead of with links as in American trucks. Thus none of the heavy express engines running these important trains have a rigid wheel base.

Of the seven types of locomotives used, two are compound, one is outside connected, and the other four are inside connected. One has a single pair of drivers, one has four drivers but no coupling rods, being on Webb's system, and the other five have four coupled drivers.

Considerable difference of practice exists with regards to the means of enabling the carriages to pass round curves. All the routes use, more or less, six-wheel carriages, with from eighteen to twenty-one feet wheel base, the boxes having some lateral motion in the pedestals or axle guards as they are called. The standard practice of the London & Northwestern is, however, an eight-wheel carriage, the end wheels having a radial motion controlled by springs. The Midland uses American pattern six-wheeled trucks under long passenger carriages, and four-wheeled bogie, with independent semi-elliptical springs above each journal box, dispensing with the heavy equalizer and in some cases with bolster springs. Two other lines use trucks under long carriages only, and the others adhere generally to the six-wheel arrangement as being lighter and simpler, though the motion round curves is not so smooth.

A compound engine of Webb's system, and made by Beyer, Peacock & Co., of Manchester, will soon be tried upon the Pennsylvania. As many of the fastest English trains are run regularly by engines of this type, it will be of interest to note their performance on American lines. Should the engine prove a failure, the cause certainly cannot be laid to the engine in the face of the scheduled speeds in 'Bradshaw,' which are not merely speeds on paper but represent what is actually performed. Possibly the inferior quality of American coal may be found unequal to supply steam in an English fire-box, which, for the work done, is generally smaller than in America. If this is not the case, there can be no reason for failure, apart from unskilful handling. With such an example of speeds before them is it not time that American trains made faster running than they do? England is a small country, and yet the English, who work much shorter hours than the Americans do, and must necessarily spend far less time in travelling between their large cities, are not satisfied unless they travel at the very highest possible speed. They certainly waste a half hour in stoppages during a run of eight and a half hours, mainly for dining. Actually therefore, they run four hundred miles in eight hours, and so would cover the nine hundred miles from New York to Chicago in eighteen hours, if they would dine on board the train. Travelling in England is very much simpler than in America. The use of sleeping cars is hardly necessary. Every important journey in the country is performed in less than nine hours, and the majority of the long journeys do not consume five hours. Hence sleepers and dining cars are a superfluity, with which few travellers in England care to be annoyed. In the United States they are indispensable, and perhaps their use has had something to do with the slowness of American trains.

SCIENTIFIC NEWS IN WASHINGTON.

The Topographic Maps of the United States Geological Survey; what They Are and What They Show. — The Proposed National Zoological Park; its Location and the Advantages of the Site. — How the Japanese Ferment, 'Koji,' is Made.

The United States Geological Survey's Topographic Maps.

"WHAT business has the United States Geological Survey to be spending the money appropriated for its work in making topographic maps on large scales?" is a pertinent question that is often asked, and more frequently of late since the Survey, in co-operation with some of the States, is rapidly pushing forward the work of mapping the area of those particular States to completion. "Why does not Major Powell, the Director of the Survey, send out his geologists to study, arrange, and represent on a geological map the rocks and minerals of the country, and let somebody else indicate on maps the hills and valleys, the forests and streams, the roads and towns?" This question contains an implied criticism of the management of the United States Geological Survey that is heard in Congress every session, and is repeated by men both in and out of government employ who think that the Survey is overstepping the limits fixed for it by law.

This question has been answered more than once, but it has been in testimony given before a commission or a committee of Congress, that never had a popular circulation, and which, if it had, is so voluminous and mixed up that very few persons would suc-

ceed in getting any definite information from it. Preliminary, therefore, to a description of these maps, and preliminary to an enumeration of some of the practical uses which they have, the question as to the authority for making them should be answered.

It is the purpose of the Director of the United States Geological Survey to make the geological map of the United States a practically useful one. It will not only show the character, extent, and positions of the rocks that underlie the surface, in a general way, but it will aim to show them exactly where they are in nature, and their relation to the surface of the ground, so that a person in possession of one of these maps may go and find the outcrop of any particular stratum, if it has an outcrop, learning from the map whether it is at the top or on the side of a hill, or in a valley, and its relative position, not only to other strata, but to the prominent landmarks of the adjacent country. But, in order to locate the geological features of a section of country accurately, it is necessary to have an accurate map showing the topographic features of the section, and no such maps had been made until the United States Geological Survey took up the work.

The topographic maps now being made are to be the basis of the geological work. Without them the latter would be in great degree useless. The preparation of them is the necessary preliminary work to the geological survey, and, as Major Powell's bureau is authorized to make a geological map of the United States, that authority necessarily implies authority to do the necessary preliminary work.

But good topographic maps, even when made primarily to be used as the basis of a geologic survey, have an incidental value in many other ways, and it is entirely proper, it is very desirable, indeed, that they shall be utilized in every possible manner. Not a single state, except two which will be referred to later, has to-day even a fairly good map of its area. The best are inaccurate and show little or nothing of the topography. The river courses, the larger ponds and lakes, and the higher hills or mountains are approximately located upon most of them, but aside from these more prominent features they give no idea of the character of the face of the country. Where roads are laid down there is generally nothing to show whether they extend over a rolling, hilly, or flat country; and any one who should attempt to drive across the country with one of the best of these maps as a guide is pretty sure to get lost and have to inquire the way. In many of the existing maps the culture, that is the houses, with the names of their owners or occupants, and other transient features in which individuals are interested, are given with considerable detail, but many permanent natural features are omitted. The former make a map sell; the latter make it of practical use in a hundred different ways.

Several of the States, recognizing the importance of having good maps of their areas, have appropriated money for that purpose, and commissions have been appointed to supervise the work of making them. But, as it is the purpose of the United States Geological Survey to make topographic maps of the entire country as bases for its geological maps, and as it has the instruments, trained expert topographers, and an organization perfected by which maps can be made much cheaper and better than they can be made by any special force organized for that purpose, it is an obvious economy for the States to employ the Geological Survey to make these maps, even though they have to pay the entire expense of them, rather than to attempt to do it themselves.

The general government also derives a direct benefit from this co-operation. If the States do not make topographic maps of their areas the United States Geological Survey will do so for its own purposes. If the States do make the maps, but make them in their own way, they will not be uniform with those made by the Geological Survey or with each other, so that, while they may be very good maps, they will be of much less use in making a geological map than if the uniformity referred to was preserved. In fact, the United States Geological Survey would eventually have to go over the same ground and make its own maps. On the other hand, if the money appropriated by the States for map making is paid over to the Geological Survey and used as far as it will go in paying the expenses of making the maps, the cost to the general government of getting such topographic maps as it needs is reduced by the amount of the State appropriations, and the expense to the States is lessened by the amount that the general government contributes.

Three States have thus far availed themselves of the opportunity to co-operate with the United States Geological Survey in making topographic maps of their areas,— Massachusetts, New Jersey, and Rhode Island. The maps of the first two have been completed and are now in the hands of the engravers. For each State there will be a large atlas of beautiful copper-plate sheets showing with almost absolute accuracy the location of every natural feature of the country, the altitude of every point, and, by contour lines, the steepness of all hills, the positions of cities, towns, villages, and post-offices, the courses of the roads, railroads, canals, etc., and, in general, every thing that is permanent in its character as distinguished from that which is temporary, or of individual rather than general interest.

The topographers are now in the field at work upon the Rhode Island map, and it will be completed this season. The area of the State is about eleven hundred square miles, and of this about four hundred square miles has already been mapped, leaving about seven hundred square miles still to be done.

Besides the work in these three States, the United States Geological Survey has made topographic maps of the Appalachian belt extending through parts of the States of Virginia, West Virginia, North Carolina, South Carolina, Georgia, Alabama, Kentucky, and Tennessee. Work has also been done in Missouri and Kansas, and a large area in those two States has been mapped. A party has been at work for two years around Fort Smith in Arkansas, and about four thousand square miles have been mapped in Texas. Around Madison, Wis., a small area has been surveyed for the benefit of Professor Chamberlin's work on glacial geology, and an experimental start has been made in Iowa. This work has all been done by the United States Geological Survey without the co-operation of the States. Some work has also been done in the Rocky Mountain region supplemental of that of the Powell, Hayden, King, and Wheeler surveys, which was done before the United States Geological Survey was organized, but which will be utilized.

The topographic maps of the United States Geological Survey are made upon three different scales. In the first, or smallest scale, one unit of distance on the map represents 250,000 units of distance in nature, or four miles in nature is represented by one inch on the map. The second scale is twice as large as the first, or 1 to 125,000, — two miles to an inch, — and the third one-fourth as large as the first, or 1 to 62,500, — one mile to an inch. In the maps of the smallest scale an atlas sheet, when it is engraved, will represent an area included within one degree of latitude and one degree of longitude. If the second scale is used there are four atlas sheets to a degree, and when the largest scale is employed it requires sixteen atlas sheets to cover one degree of latitude and one degree of longitude. The maps of Massachusetts, Rhode Island, and New Jersey are made upon the largest scale.

The question as to the best scale for maps and the minuteness of detail that it is wise to attempt to represent has been a great deal discussed by map-makers, but no agreement has been reached. The publication scale of the United States Geological Survey maps and the size of the sheets which the topographers use in the field have necessarily no definite relation to each other. Some men do better work upon a large than upon a small sheet, but the tendency is, with every year's experience, to work nearer and nearer to the publication scale; that is, to put into the original map all that can be shown on the engraved sheet without confusion, and to omit other details.

The questions that are asked the topographers when they are in the field disclose the particular features of a map in which the people are most interested. For instance, in Rhode Island great interest is manifested in the development of water power and also in regard to the altitude of the higher hills of the State. In explanation of the frequent question whether this hill or that is not the highest in the State, it may be said that a great many of the farmers of Rhode Island are becoming more dependent upon summer boarders than upon the products of their generally sterile lands for their support, and every one whose house is on the top of a hill would like to be able to say that it is on the highest point in the State. How little was known about the relative altitudes of the

hills of Rhode Island is shown by the fact that in the report of the State census of 1885 several hills are mentioned each of which has been asserted on what was supposed at the time to have been good authority to be the highest in the State. The greatest altitude of all of these, that of Woonsocket Hill, was given as 570 feet. The United States Geological Survey engineer who has been running levels over the State found that the altitude of the road across Chopmist Hill is more than 700 feet. Chopmist Hill was not in the State census list.

The United States Geological Survey topographic maps have already been found to be of great practical use in locating roads and railroads, and in the development of the mineral resources of the country. The illustrations of this are constant and numerous. General Wilder of North Carolina was interested in a projected railroad from Charleston, S.C., to a point in North Carolina to reach which it was necessary to cross a mountainous country. After examining the maps of the region made by the United States Geological Survey he said that they were worth ten thousand dollars to his company. They showed that the route they had contemplated was impracticable, and to have ascertained that by a special survey would have cost the sum named. The Canadian Pacific Railway Company made four trial surveys before its engineers were able to select the best route across the Rocky Mountains. The cost of these trial surveys was three million dollars, a sum that would have paid for making a topographic map of the whole region upon a four mile to an inch scale, and such a map would have shown the best practicable route at a glance. As these surveys are extended over greater and greater areas their uses will multiply. The Great West has developed much of its resources in advance of the map-maker; the New South, more fortunate, will have the aid of the map-maker, and consequently will develop its mineral resources and lay out its railroads at much less expense.

A question that is constantly asked at the United States Geological Survey office is, "Have you a map of such or such an area, and if so, where can I get a copy?" The answer that has to be given, when the area referred to has been mapped, is that no provision for publishing the map has been made. The organic law of the Survey does provide for the sale of its publications, but the topographic maps are not, in law, complete work. They are only data or material for the use of the geologist. It is not necessary, in order that they shall be available for geological work, that these maps shall be engraved, and by no other method of reproduction can copies for popular use be satisfactorily made. It is to be hoped that Congress, appreciating the value to the people of these maps, will authorize them to be engraved and copies of them to be sold at cost. In cases of State co-operation provision for the reproduction and distribution of the maps is made by the legislature.

The Proposed National Zoological Park.

The Senate has added to the sundry civil appropriation bill a provision for a national zoological park on Rock Creek, in the suburbs of Washington. The site selected is one of the best for such a purpose in the country. Through the centre of it winds Rock Creek, a most picturesque little stream, from the banks of which, on either side, rise a series of beautiful hills covered with fine timber. The tops of many of these hills have already been selected for villa sites, and a great number of beautiful surburban residences have either already been built or are in contemplation. The system of street railways is to be extended from the city into this section, so that the proposed park will be easily accessible by a short and pleasant ride, while the drive to and through it will not be surpassed in beauty by any in the suburbs of any other American city.

The area of the proposed zoological park is about one hundred and twenty-one acres. About three-fourths of it is covered with forest, and although its length is only three-fourths of a mile, the course of the stream in passing through it is more than a mile and one-third. It is believed that the entire tract can be purchased for less than two hundred thousand dollars. The distance from the White House to the proposed entrance to the park is but a little more than two miles.

In the National Museum the general government has provided for the preservation of objects representing the archæology, geology, mineralogy, and flora of the country, and its progress in the arts and sciences, and the Senate has already approved a measure providing for an additional building, which, when completed, will more than double the exhibition space now available. But the fauna of this country is becoming extinct more rapidly in many of its branches than any other of its interesting aboriginal features. Some species of animals have already disappeared from sections where they formerly were plentiful, and others are now but rarely found. No provision has ever been made for the preservation of specimens of these native animals; no provision can be made except by the government of the United States, and not even in the way now proposed if there is much longer delay. If Congress acts promptly in authorizing the establishment of a national zoological park, specimens of animals that have already become practically extinct, although they were numerous when America was first settled by Europeans, may yet be obtained, and in time the entire fauna of the country may be represented. It is hoped that the House of Representatives may agree to the moderate appropriation for this purpose proposed by the Senate.

Preparation of Japanese 'Koji.'

In response to a request from Dr. W. M. Murtrie, professor of chemistry in the University of Illinois, the State Department has obtained from Prof. C. C. Georgeson of the Imperial Japanese Agricultural College at Tokio an account of the method of preparing the peculiar ferment called 'koji.' It is made, Professor Georgeson says, both in 'sake' breweries and 'koji' factories, and one of the essential conditions of its production is that an even temperature shall be preserved in the fermenting rooms. In 'koji' factories these apartments are usually fifteen or twenty feet underground, in some sufficiently dry place, and are reached by means of a shaft, while in 'sake' breweries these chambers are frequently arranged in ordinary buildings, the walls being lined with straw mats and mud to prevent radiation.

The materials used are water, rice and 'tane' (seed or leaven). The rice is the common starchy kind known as 'uruchi.' Glutinous rice ('*mochigome*') is not used. The 'tane' is the spores of a fungus, *eurotium oryzeæ ahlb.*, and occurs as a yellow powder, which, at a certain stage of the process, is mixed with the rice. It is the substance which, in germinating on the rice grain, changes part of the starch into dextrose and dextrin, and gives it the properties of a ferment.

The rice is first thoroughly cleaned and the thin covering ('*testa*') of the seed is removed. If this is not done the liquids with which the 'koji' is mixed would be inclined to putrefy. The rice is then washed by stirring it in a tank of water till all the dust and adhering fine particles are floated off, after which it is steeped for some hours to soften the grain.

The steaming may be done in the ordinary way by means of a steam boiler, although the Japanese method is much more primitive. When this is completed the rice is spread upon straw mats to cool. When the temperature has fallen to 98° or 100° F. the 'tane' is sown upon the mass and thoroughly mixed with it. The thorough and uniform distribution of the 'tane' is more important than the exact quantity used. The amount is generally 1½ to 2 cubic centimetres per bushel of steamed rice. The 'tane' used in most factories is obtained in Osaka, but as to the manner of its production Professor Georgeson says he is not fully informed. So far as he can learn, however, since those who produce it keep their methods secret, the rice impregnated as described above will in due time mature the plant, and the spores will form on the surface of the grain as a yellow powder. When the crop is ripe, the rice is dried, spread upon paper, and then stirred or rubbed until the spores are detached by attrition and collected on the paper. The 'tane' is said to be produced chiefly in winter.

In the production of 'koji,' after the 'tane' is mixed with the rice the mass is allowed to remain in bulk eighteen or twenty hours, being simply covered with mats. The temperature of the room is not kept high at this stage. The next day the rice is distributed into shallow wooden trays, each holding about three litres, and spread in a thin layer on each. These trays are then carried to the warmest room, where the minimum temperature should not be

lower than 75° F., and here either placed on shelves or piled one on the other on the floor. In some cases the rice is sprinkled with water and left standing in baskets several hours before it is distributed on the trays. In other cases the trays are not placed in the warm room until toward evening of the second day (the day after sowing the 'tane'), and they are then left undisturbed until early in the morning of the third day. When the rice is not moistened the trays are left standing only four or five hours, when the contents of each must be thoroughly stirred by hand, which process is repeated after another four hours of rest. At this stage the fungus grows rapidly and much heat is evolved; the grain becomes opaque, assuming a fibrous texture and becoming somewhat sour in taste. After from four to ten hours the trays are emptied of their contents and the rice spread thinly on mats to cool. It is then 'koji.'

There is a loss of weight during the process of from ten to twelve per cent of the rice used. This is due to the evolution of carbonic acid, which makes the ventilation of the room necessary in order to make it possible for the men to remain in it. The usual mode of ventilation is to insert a perpendicular flue, which can be opened or closed at pleasure, extending from the ceiling to the outside air, and an inclined or horizontal flue which discharges fresh air near the floor.

ELECTRICAL SCIENCE.

A New Diffusion Photometer.

MR. J. JOLY has brought out a new photometer which is simple and sensitive. One form consists of two parallelopipeds of paraffin of equal dimensions, planed smooth so they can be laid accurately together on similar faces. Putting these together with the plane of discontinuity at right angles with the line joining the lights to be compared, the compound block is moved toward one or the other of them until the fine line of division between the two pieces almost or wholly disappears. The distances from the lights to the plane of discontinuity are now measured, and the relative intensities reckoned as inversely as the squares of the distances. In the case of lights of dissimilar colors the appearance of the photometer is no longer uniform, but that of two softly glowing substances of different colors. Even under these circumstances, if the colors are not greatly different a point of minimum distinctness of the line can be found with considerable accuracy, The greater sensitiveness of this photometer over some of the other forms used is due to the fact that we have to concentrate all of our attention on the line of junction only, not on two images at some distance apart. Instead of paraffin, glass of a transluency approaching that of paraffin may be used, and the effect may be heightened by interposing between the two pieces a sheet of silver foil. The dimensions that Mr. Joly finds best are 20 by 50 by 11 millimetres for each parallelopiped. They are laid together on two of the larger faces, the parallel external faces being ground smooth, but left unpolished. The surface under observation during the experiment is ground smooth and polished after joining the parallelopipeds. The most important points to be attended to in their construction are fineness of division line and uniformity in thickness. Should there be any difference in the translucency of the parallelopipeds a check observation might be made by turning over the photometer so that the halves change places relatively to the lights, taking the mean of the observations. This is, however, rarely necessary. This compound block is mounted in the same way as an ordinary Bunsen photometer, and the same precautions are necessary in using it.

ELECTRIC TRACTION ON THE UNDERGROUND ROADS IN LONDON. — Nowhere can electricity be more easily employed for traction work than on the underground roads that are to London what the elevated roads are to New York. The rational method of employing it is to use motors supplied from an overhead wire, the electricity being generated at stations along the lines. The objections sometimes urged against the overhead system for use on city streets cannot apply here, and there would be little doubt of the economy of the system, besides the great advantages it would possess as far as ventilation and comfort went. Instead of using a direct current, however, it is proposed to employ storage batteries on the train. The motors are to have a capacity of 600-horse power, and when one considers the difficulties that have been experienced in getting a battery of reasonable weight that will give a maximum output of ten or fifteen horse power for ordinary tramway work, it would seem that the plan is almost certain to fail. A hundred tons of battery might be sufficient, but with the initial cost of it, its deterioration, and the power that must be expended to draw it, the chances for the economical working of the system are small.

TRANSFORMERS BASED ON ELECTROSTATIC INDUCTION. — M. Doubrava has described a method of reducing currents of high potential and small quantity to those of low potential and great quantity by means of electrostatic condensers. He first charges a condenser of comparatively small capacity to a high potential, then disconnects it from his line and discharges it into a condenser of great capacity, thereby lowering the difference of potential between the coatings, and finally he discharges the large condenser into the lamp-circuit which he wishes to feed. By performing this operation fast enough a practically continuous current is obtained in the latter circuit. While the general idea of using condensers for transforming high to low potential currents is not new, and while methods have been proposed which seem as promising as that of M. Doubrava, yet his system has in it some elements of novelty. The difficulty lies in the great capacity of the condensers that will be required. Taking the charges and discharges as rapid as seems practicable; the condensers — supposing the distribution is at 200 volts — would have to have a capacity of about 1,000 micro-farads for every horse-power transformed. Now a condenser of 1000 micro-farads capacity is enormous, and would be expensive to build and too large to conveniently store. The efficiency of the system would be, probably, very high, but it would require rotating apparatus of some description, which, with the fact that house to house distribution at high potential would be dangerous, would necessitate the distribution of the low-potential currents from sub-stations. When one tries to imagine a sub-station distributing 500-horse power, with a condenser of a capacity of 500,000 micro-farads, the system will seem a doubtful one.

ALLOYS FOR ELECTRICAL RESISTANCES WITH NO TEMPERATURE CO-EFFICIENT. — Mr. Edward Weston has discovered an alloy whose specific resistance is high and whose resistance is not affected by temperature changes within ordinary limits. This is valuable for electrical resistances, and will doubtless have an extended use. The alloy is a mixture of copper and manganese. It may be made from copper and ferro-manganese in the proportions, copper 70 parts, ferro-manganese 30 parts. A still more curious alloy is made from copper 65 parts, ferro-manganese 25 to 30 parts, nickel 2½ parts. This possesses the remarkable property of decreasing in resistance as its temperature rises, a peculiarity heretofore ascribed to carbon and electrolytes only. This last alloy can be used with ordinary copper or German silver coils in such proportion as to cause the total temperature co-efficient to be zero. It is to be hoped that these substances will be carefully studied and their properties at high and low temperatures determined.

CHEMICAL ACTION IN A MAGNETIC FIELD. — Since 1881, when Professor Remsen discovered that the deposition of iron was affected by a strong magnetic field, experiments have been tried to determine the nature of the effect of magnetism on chemical action. The latest and most satisfactory contribution on the subject is that of Prof. H. A. Rowland and L. Bell, in the current number of the *American Journal of Science*. Their general method was to take two pieces of the metal to be experimented on, put them in circuit with a galvanometer, and immerse them in an electrolyte between the poles of a powerful magnet. The two pieces were covered with wax except at two opposite points, where they were bare, and by changing the shapes of the uncovered portions the condition of their surfaces with respect to the rate of change of magnetic force could be varied. For instance, in the first experiment that was tried pieces of iron were immersed in dilute nitric acid. One of the bare surfaces was flat, the other filed to a sharp point. If there was no deflection of the galvanometer when the circuit of the magnet was made, there was a sharp throw immediately on making the circuit, the needle then gradually returning to zero and going past to the other side. The throw was in a direction as if the sharp point was copper and the flat surface zinc. When the point was